REMARKS

Rejection of Claims 1-31 Under 35 U.S.C. § 251

Claims 1-31 are rejected as being based on a defective reissue inventor oath/declaration under 35 U.S.C. § 251 because the inventor oath/declaration filed with the application does not indicate any residence, mailing address or country of citizenship for inventors Hess or Goehring.

The Applicants submit herewith an inventor oath/declaration executed by the inventors Hess and Goehring bearing their residence, mailing addresses and citizenships. Accordingly, the Applicants respectfully request the Examiner withdraw the rejection of claims 1-31 under 35 U.S.C. § 251.

Rejection of Claims 15 and 29-31 Under 35 U.S.C. § 112

Claims 15 and 29-31 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the Applicants regard as their invention. The Applicants have amended claims 15 and 29-31 in accordance with the Examiner's suggestions. The Applicants respectfully request the rejection of claims 15 and 29-31 under 35 U.S.C. § 112 be withdrawn.

Rejection of Claims 1, 2 6-14 and 31 Under 35 U.S.C. § 103(a)

Claims 1, 2, 6-14, and 31 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Anderson (U.S. Patent No. 4,419,303). The Applicants respectfully traverse the rejection of claims 1, 2, 6-14, and 31 under 35 U.S.C. § 103(a) for the

reasons give below. One of ordinary skill in the art would not have been motivated by the process disclosed by Anderson because Anderson does not teach or suggest the method of claim 1 or claim 31.

Claim 1 has been amended and is directed to a method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of providing a supply of a low viscosity liquid material in a crucible, applying a minute periodic disturbance to the low viscosity liquid material in the crucible, applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least a first heat transfer medium and a second heat transfer medium, the first and the second heat transfer media forming a heat gradient within the enclosed controlled low temperature solidification environment. The method further comprises breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and allowing the liquid spheres to pass through the first heat transfer medium and the second heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

In contrast with claim 1, Anderson does not teach or suggest a method including the enclosed controlled low temperature solidification environment containing at least a first heat transfer medium and a second heat transfer medium forming a heat gradient. Anderson discloses a process carried out in a purification vessel 10 having an upper

vessel section 12 and a lower vessel section 38. The lower vessel section 38 includes a cooling gas inlet 40, a condensation chamber 41 and a collection chamber 50. Droplets 33 of molten amalgam are formed when molten amalgam is forced from the upper vessel section 12 through a nozzle 26 and is vibrated by vibrating means 25 such that the molten amalgam separates into discrete droplets 33. The droplets 33 fall freely into the condensation chamber 41 of the lower vessel section 38. The condensation chamber 41 contains an inert cooling fluid, e.g., cooled helium gas, to solidify the droplets into solid amalgam particles as the droplets 33 fall through the condensation chamber 41. The cooling fluid may be introduced into the lower vessel section 38 through the gas inlet 40 and maintained at a temperature well below the melting point of the amalgam by circulating liquid nitrogen through a cooling jacket 44 surrounding the lower vessel section 38.

The Examiner concludes that Anderson does not specify the presence of a heat gradient as recited in claim 1, and that this difference is not a patentable distinction. The Examiner bases this conclusion on the assumption that a heat gradient is present in the Anderson process. The Examiner explains that the temperature of the cooled helium gas in the lower vessel section 38 would vary with the temperature at a point located near to a cooling source, e.g., liquid nitrogen circulating in a coolant jacket 44 around the lower vessel section 38, being the coolest and the temperature at a point located farthest from the cooling source being relatively higher.

The Applicant respectfully submits that Anderson does not teach, disclose or suggest a heat gradient in the lower vessel section 38, but, rather, discloses the coolant jacket 44 surrounding the lower vessel section 38 and containing liquid nitrogen to

maintain a temperature of the lower vessel section 38, e.g., sufficient to solidify the droplets of amalgam melt. (col. 3, lines 26-34; col. 4, lines 49-55; and col. 5, lines 30-33). The purpose of the liquid nitrogen in the jacket 44 is to maintain temperature and does not create a temperature gradient.

In contrast, claim 1 recites a method of allowing the liquid spheres to pass through the first heat transfer medium and the second heat transfer medium wherein the first and the second heat transfer media form a heat gradient. As noted above, Anderson does not teach, disclose or suggest either a heat gradient nor the heat gradient as recited in claim 1. The Examiner, however, assumes a heat gradient is present in the lower vessel section 38 as a consequence of the indirect heat exchange between the coolant jacket 44 and the helium gas. Such an inherent gradient may or may not exist at any given time during operation of the Anderson process, but Anderson neither teaches, discloses or suggests this possibility. Nor does Anderson teach, disclose or suggest the heat gradient of claim 1 created by the first heat transfer medium and the second heat transfer medium. Rather, Anderson discloses the coolant jacket 44 with liquid nitrogen contained therein to maintain a temperature of the lower vessel section 38. One of ordinary skill in the art, therefore, would not be motivated by Anderson to provide the first heat transfer medium and the second heat transfer medium to form the heat gradient through which the liquid spheres pass for solidification. Claim 1, therefore, is patentable over Anderson. Accordingly, the rejection of claim 1 under 35 U.S.C. § 103(a) should be withdrawn.

Claims 2 and 6-14 are dependent on claim 1 and patentable for at least the same reasons given above.

Similar to the argument given above with respect to claim 1, Anderson does not teach or suggest a method for forming and solidifying uniform sized and shaped solid spheres comprising the enclosed controlled low temperature solidification environment containing a first heat transfer medium and a second heat transfer medium forming a heat gradient through which the liquid material passes as recited in amended claim 31. Claim 31, therefore, is patentable over Anderson and the rejection of claim 31 under 35 U.S.C. § 103(a), accordingly, should be withdrawn.

New Claims 32-36

The Applicants have added new claims 32-36 to the present application. The new claims do not add new subject matter to the application and have proper antecedent basis. New independent claim 32 is directed to a method for forming and solidifying uniform sized and shaped solid spheres, the method comprising: providing a supply of a low viscosity liquid material in a crucible, applying a minute periodic disturbance to the low viscosity liquid material in the crucible, applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment. The method further comprises breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

Similar to the foregoing discussion with respect to claims 1 and 31, new claim 32 is patentably distinguishable over Anderson because Anderson does not disclose or suggest the heat transfer medium forming the heat gradient in the controlled low temperature solidification environment. Anderson does not provide a teaching or a suggestion that would motivate one of ordinary skill in the art to form the heat gradient through which the liquid spheres pass to cool and solidify into the uniform sized and shaped solid spheres. Claim 32 is patentably distinguishable over Anderson. Claims 33-36 depend from claim 32 and are patentable for at least the same reasons. The Applicants respectfully request the Examiner consider new claims 32-36 and enter the claims into the record.

To further prosecution of the present application, the Applicants have amended claims 15 and 29-31 in accordance with the Examiner's suggestions to overcome the rejection of claims 15 and 29-31 under 35 U.S.C. §112, second paragraph.

The Applicants have amended claims 1-4, 15-16, and 29-31. The claim amendments do not add new subject matter to the application and have proper antecedent basis. The Applicants respectfully request the Examiner consider the foregoing amendments and enter the amendments into the record.

The Applicants submit herewith the reissue oath/declaration executed by the inventors Hess and Goehring that includes the residence, mailing address and country of citizenship of each inventor.

The Applicants submit herewith a Consent For Reissue Patent pursuant to 37 C.F.R. § 3.73(b) executed by the assignee of record, Alpha Metals (Korea) Ltd. The first assignee, Fry's Metals, Inc., assigned the patent (U.S. 5,891,212) that is the subject of the present reissue application, to Alpha Metals (Korea) Ltd. on July 30, 2001. The Applicants believe the enclosed consent satisfies the requirements within 37 C.F.R. § 3.73(b).

The Applicants respectfully submit that a copy of the specification was furnished in double column format on November 9, 2001 in response to the Reissue Supplement to the Notice To File Missing Parts. A copy of the specification in double column format as filed on November 9, 2001 is submitted herewith.

Claims 1-36 are presently pending in the application. A marked-up version of the claim amendments is attached herewith as Appendix A. In addition, a clean version of the claims pending in the present application is attached herewith as Appendix B.

On the basis of the foregoing amendments and discussion, the Applicants believe the present application is in condition for allowance, which action is respectfully requested. Should the Examiner have any questions, he is invited to telephone the undersigned at the number provided.

Respectfully submitted,

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APPENDIX A

1. (Twice Amended) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least [one] <u>a first</u> heat transfer medium <u>and a second heat transfer medium</u>, the <u>first heat transfer medium and the second</u> heat transfer medium] forming a heat gradient within the enclosed controlled low temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the <u>first</u> heat transfer medium <u>and the second heat transfer medium</u> in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

2. (Amended) The method of claim 1, in which the enclosed [con-trolled] <u>controlled</u> temperature solidification environment includes a first[,] <u>or</u> gaseous

environment through which the [charged] spheres are passed, the first[,] or gaseous environment containing the first heat transfer medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon which evaporates in the enclosed controlled temperature solidification environment and which absorbs the heat of fusion from the spheres.

3. (Amended) The method of claim 2, in which the enclosed [con-trolled] controlled temperature solidification environment includes a second[,] or liquid environment through which the spheres pass after passing through the first[,] or gaseous environment[;], the second[,] or liquid environment containing [a] the second heat transfer medium which comprises a supply of a liquid material.

4. (Amended) The method of claim 3, comprising passing the spheres through the second[,] or liquid environment to remove heat from the spheres and to cushion the B1 spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

B2 15. (Twice Amended) The method of claim 29, in which the deflection means comprises two spatially separated surfaces and comprising generating the [electrical] electric field between the two surfaces to deflect the [descending] liquid spheres.

16. (Twice Amended) A method for forming uniform sized and shaped spheres comprising the stops of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed [con-trolled] controlled temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres; and

allowing the spheres to pass through first and second media in an enclosed controlled temperature solidification environment to cool and solidify the spheres;

the enclosed controlled temperature solidification environment including a first[,] or gaseous environment through which the charged spheres are passed, the first[,] or gaseous environment containing the first medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon, the first medium evaporating in the enclosed controlled temperature solidification environment and absorbing the heat of fusion from the spheres;

the enclosed controlled temperature solidification environment also including a second[,] or liquid environment through which the spheres pass after passing through the

B2

first, gaseous environment, the second[,] or liquid environment containing the second medium which comprises a supply of a liquid material, the second medium cushioning the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

29. (Amended) The method of claim 1, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing [the charged] liquid spheres to which the charge has been applied through an electric field to deflect the charged liquid spheres.

30. (Amended) The method of claim 16, further comprising steps of:
applying a charge to the stream of material as the stream exits the orifice; and
passing [the charged] liquid spheres to which the charge has been applied through an electric field to deflect the charged liquid spheres.

31. (Amended) A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

applying a pressure to low viscosity liquid material contained in a crucible, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least [one] a first heat transfer medium and a second heat transfer medium, the first heat transfer

<u>medium and the second</u> heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment; <u>and</u>

allowing the liquid [spheres] <u>material</u> to pass through the <u>first heat transfer medium and the second</u> heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

32. (New) A method for forming and solidifying uniform sized and shaped solid spheres, the method comprising:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

33. (New) The method of claim 32 wherein forming the heat gradient includes the enclosed controlled temperature solidification environment including a first or gaseous environment containing the first heat transfer medium at a temperature of a first desired value through which the liquid spheres pass.

34. (New) The method of claim 33 wherein the first heat transfer medium includes a spray of cooling fluid, liquefied gas or halo-carbon which evaporates in the enclosed controlled temperature solidification environment and which absorbs the heat of fusion from the liquid spheres.

35. (New) The method of claim 33 wherein forming the heat gradient further includes the enclosed controlled temperature solidification environment including a second or liquid environment containing a second heat transfer medium at a temperature of a second desired value through which the liquid spheres pass after passing through the first or gaseous environment.

36. (New) The method of claim 35 wherein the second heat transfer medium includes a supply of liquid material which removes heat from the spheres and which cushions the spheres before the spheres contact a bottom of the enclosed controlled temperature environment.

APPENDIX B

1. A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

providing a supply of a low viscosity liquid material in a crucible,

B1

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least a first heat transfer medium and a second heat transfer medium, the first heat transfer medium and the second heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the first heat transfer medium and the second heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

2. The method of claim 1, in which the enclosed controlled temperature solidification environment includes a first or gaseous environment through which the

spheres are passed, the first or gaseous environment containing the first heat transfer medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon which evaporates in the enclosed controlled temperature solidification environment and which absorbs the heat of fusion from the spheres.

3. The method of claim 2, in which the enclosed controlled temperature solidification environment includes a second or liquid environment through which the spheres pass after passing through the first or gaseous environment, the second or liquid environment containing the second heat transfer medium which comprises a supply of a liquid material.

4. The method of claim 3, comprising passing the spheres through the second or liquid environment to remove heat from the spheres and to cushion the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

15. The method of claim 29, in which the deflection means comprises two spatially separated surfaces and comprising generating the electric field between the two surfaces to deflect the liquid spheres.

16. A method for forming uniform sized and shaped spheres comprising the stops of:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres; and

allowing the spheres to pass through first and second media in an enclosed controlled temperature solidification environment to cool and solidify the spheres;

the enclosed controlled temperature solidification environment including a first or gaseous environment through which the charged spheres are passed, the first or gaseous environment containing the first medium which comprises a spray of cooling fluid, liquefied gas or halo-carbon, the first medium evaporating in the enclosed controlled temperature solidification environment and absorbing the heat of fusion from the spheres;

the enclosed controlled temperature solidification environment also including a second or liquid environment through which the spheres pass after passing through the first, gaseous environment, the second or liquid environment containing the second medium which comprises a supply of a liquid material, the second medium cushioning

the spheres before the spheres contact a bottom of the enclosed controlled temperature solidification environment.

29. The method of claim 1, further comprising steps of:

applying a charge to the stream of material as the stream exits the orifice; and

passing liquid spheres to which the charge has been applied through an electric field to deflect the charged liquid spheres.

30. The method of claim 16, further comprising steps of:

applying a charge to the stream of material as the stream exits the orifice; and

passing liquid spheres to which the charge has been applied through an electric field to deflect the charged liquid spheres.

31. A method for forming and solidifying uniform sized and shaped solid spheres comprising the steps of:

applying a pressure to low viscosity liquid material contained in a crucible, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least a first heat transfer medium and a second heat transfer medium, the first heat transfer medium and the second heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment; and

allowing the liquid material to pass through the first heat transfer medium and the second heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

32. A method for forming and solidifying uniform sized and shaped solid spheres, the method comprising:

providing a supply of a low viscosity liquid material in a crucible,

applying a minute periodic disturbance to the low viscosity liquid material in the crucible,

applying a pressure to the low viscosity liquid material, the pressure forcing the material through at least one orifice in the crucible as a steady laminar stream, the stream of the material exiting into an enclosed controlled low temperature solidification environment having a temperature of less than about 0° C., the enclosed controlled low temperature solidification environment containing at least one heat transfer medium forming a heat gradient within the enclosed controlled low temperature solidification environment;

breaking the stream of material up into a plurality of uniform sized and shaped liquid spheres, and

allowing the liquid spheres to pass through the heat transfer medium in the enclosed controlled low temperature solidification environment to cool and solidify into the uniform sized and shaped solid spheres.

33. The method of claim 32 wherein forming the heat gradient includes the enclosed controlled temperature solidification environment including a first or gaseous environment containing the first heat transfer medium at a temperature of a first desired value through which the liquid spheres pass.

34. The method of claim 33 wherein the first heat transfer medium includes a spray of cooling fluid, liquefied gas or halo-carbon which evaporates in the enclosed controlled temperature solidification environment and which absorbs the heat of fusion from the liquid spheres.

35. The method of claim 33 wherein forming the heat gradient further includes the enclosed controlled temperature solidification environment including a second or liquid environment containing a second heat transfer medium at a temperature of a second desired value through which the liquid spheres pass after passing through the first or gaseous environment.

36. The method of claim 35 wherein the second heat transfer medium includes a supply of liquid material which removes heat from the spheres and which cushions the spheres before the spheres contact a bottom of the enclosed controlled temperature environment.